Weighing the snow core to determine the water content

FEDERAL-STATE COOPERATIVE SNOW SURVEYS AND IRRIGATION WATER FORECASTS

for

RIO GRANDE DRAINAGE BASIN

APRIL 1, 1945

By

Division of Irrigation, Soil Conservation Service
United States Department of Agriculture
and
Colorado Agricultural Experiment Station

Data included in this report were obtained by the agencies named above in cooperation with the U. S. Forest Service, National Park Service, State Engineers of Colorado and New Mexico and other Federal, State and local organizations.

April 1, 1945

WATER SUPPLY OUTLOOK

RIO GRANDE

The water supply outlook for the Rio Grande is now promising. It is expected to exceed that of last year by about 20 percent. Reservoir storage, both in Colorado and New Mexico is much improved over that a year ago and because of the favorable snow cover in the high mountains, a very substantial additional amount of storage will be realized during the spring runoff. The runoff prospects for the Pecos and Canadian are favorable for a satisfactory irrigation water supply this season.

RIO GRANDE: During the month of March the water content of the snow on the watershed of the Rio Grande increased on the average about 4 inches. The ten snow courses on the headwaters of this stream, in the San Luis Valley area in Colorado, also gained an average of 4 inches in water content during the past month. The heaviest fall of snow during this period occurred on Wolf Creek Pass where the water content on two snow courses increased 12 inches. On Cumbres Pass the month's increase was about 10 inches of water. For the 14 snow courses on the watershed of this stream and tributaries in northern New Mexico, the average increase in the water content of the snow during the past month was a little more than 2 inches; the greatest increase occurring on Canjilon Pass of about 6 inches. For the drainage as a whole the present average water content of the snow cover is 12.6 inches. This amount is about one inch over that of last year at this time and now exceeds the past 9-year average by nearly 2 inches.

The reservoir storage in the San Luis Valley area now totals 72,000 acre-feet and at this time last year it was 48,000, or 50 percent more. The Elephant Butte and Caballo, combined storage, totals 1,503,000 acre-feet and last year was 1,431,000 or about 10 percent more. For the whole Rio Grande drainage the storage of water for the coming irrigation season is very substantial and because of the very favorable condition of the snow on the high mountains of the watershed it can be assumed that the final filling will be sufficient to meet the full needs for 1945.

Throughout the irrigated area of the Rio Grande Valley the soil moisture is generally fair to good and stream flow about normal with some indications of rising stage in tributary streams due to runoff from snow at lower elevations. There is no snow over the floor of the San Luis valley. On the Red River drainage the present water content of the snow is 16 inches. This is the greatest amount for April 1 over the past 9 years, except for 1941 when the water content was 17.6 inches. In all probability this stream will reach a high stage during the spring runoff and make a substantial contribution to the season's flow of the Rio Grande itself.

The outlook for the coming season's irrigation water supply is at this time very favorable. The snow-water storage is above normal, the

reservoir filling is good, soil conditions in the lower areas favorable, but in the mountain country the soils are relatively dry due to last fall's deficiency in precipitation. It can be reasonably expected that April and May storms over this drainage basin will add further to the present favorable outlook. The present prospects appear to indicate no unusual high stage of river flow during the spring runoff. At this time the snow cover over this drainage area averages 12.6 inches while for April 1, 1941 it was 16.1. The April-July 1945 flow in the South Fork will approximate 150,000 acre-feet, the same as last year, and for the Conejos 250,000 acre-feet. The irrigation water supply for the coming season will be equal to, if not better, than it was in 1944. The Elephant Butte and Caballo combined storage will approach a total of 1,750,000 acre feet as a maximum in 1945.

RIO CHAMA: For this drainage the average water content of the snow is now about 17 inches as compared with 14 a year ago. The snow condition is above normal and the runoff this season can be expected to exceed that of last year by at least 20 percent. In the El Vado Reservoir, on the Rio Chama, the present storage is approximately 100,000 acre-feet, a year ago it was 45,000. Because of the present favorable prospects for runoff from this watershed there is little doubt as to having sufficient water to fill this reservoir to full capacity. On Cumbres Pass the snow depth is a little more than 7 feet and contains 30 inches of water. This condition is about 80 percent of 1941 when the flow of this river at Chamita, for the period April-July, totaled about 700,000 acre-feet.

RIO PECOS: The snow conditions on the headwaters of this stream improved during March by one inch in water content and now exceed the 9-year average by 2 inches. The general over-all outlook for the irrigation water supply for 1945, as based on snow cover and other factors appears at this time to be quite favorable. Soil moisture, crop and range conditions in the lower valley continue to be satisfactory, however, reservoir storage is about the same as it was a year ago.

CANADIAN RIVER

During March there was an average increase of 2.5 inches in the water content of the snow on the headwaters of this stream and is now about 3 inches above normal. The situation is much improved over last year at this time and because of the apparent favorable prospects it can be reasonably expected that the runoff in this stream for 1945 will provide an ample irrigation supply during the early part of the season. The total storage in the Conchas Reservoir is at present 345,000 acre-feet. Last year the amount of water held was 294,000 or now better by about 50,000 acre-feet. During March no additional storage was realized. Soil moisture is fair over the project lands in the vicinity of Tucumcari and range and crop conditions continue to be good. It is not likely that any serious water shortage on the project area will be experienced this year.

SNOW SURVEYS AND IRRIGATION WATER FORECASTS
for
RIO GRANDE BASIN

April 1, 1945

PRECIPITATION DATA

WATERSHED	STATE	Precipitation October 1 to March 31	Departure from Normal	Precipitation March	Departure from Normal
		Inches	Inches	Inches	Inches
Canadian	New Mexico	4.30	+0.25	0.31	-0.44
Rio Grande	Colorado	8.57	+1.54	2.02	+0.57
Rio Grande (N)	New Mexico	7.39	+0.85	1.33	+0.08
Rio Grande (S)	New Mexico	3.96	+0.14	0.37	-0.25
Pecos	New Mexico	3.87	-0.57	0.28	-0.48

Precipitation was generally below normal over the watersheds of the Pecos, Canadian and Rio Grande in New Mexico during March, but it was above normal over the watershed of the Rio Grande in Colorado. The accumulated precipitation from October 1 to March 31 was, however, above normal except over the Pecos watershed where there was a small deficiency.

SUMMARY OF APRIL 1 SNOW SURVEYS AND COMPARISON OF DATA WITH THAT OF PREVIOUS YEARS BY WATERSHEDS

WATERSHED	Snow Depth			Water Content			Number Courses in Average	Snow Density			1945 Water Content in percent of	
	Nine Year Avg.*	1944	1945	Nine Year Avg.*	1944	1945		Nine Year Avg.*	1944	1945	Nine Year Avg.*	1944
	In.	In.	In.	In.	In.	In.		Percent	Percent	Percent		
Rio Grande	31.4	35.6	38.9	10.5	11.7	12.6	23	33	33	32	120	108
Chama River	41.2	40.2	48.7	15.2	14.0	16.8	5	37	35	34	110	120
Pecos River	14.5	17.4	22.2	4.8	5.8	6.8	3	33	33	31	142	117
Canadian River	23.3	28.2	30.4	7.4	8.4	10.0	4	32	30	33	135	119

*Some for shorter periods.

RIO GRANDE WATERSHED

Summary of Federal and State Cooperative Snow Surveys
Issued April 10, 1945, at Fort Collins, Colorado

No.	Main Drainage and Snow Course	Local Drainage	Location			Elev.	National Forest	Apr. 1 Snow Cover Measurements					
			State	Locality	Description			Av. Snow Depth			Av. Water Content		
								Av.@	1944	1945	Av.@	1944	1945
	RIO GRANDE							In.	In.	In.	In.	In.	In.
26	Wolf Creek Pass	South Fork	Colo.	Wolf Cr.Pass	4-37N-2E	10000	Rio Grande	85.9	98.2	88.4	31.4	36.8	33.4
27	Upper Rio Grande	Rio Grande	"	Rio Grande Res.	13-40N-4W	9350	" "	21.9	34.4	21.7	5.5	11.5	5.4
47	Silver Lakes	Alamosa R.	"	1mi.S.Silver L.	15-36N-5E	9600	" "	22.4	35.2	29.4	6.2	10.5	7.9
49	River Springs	Conejos R.	"	10mi.W.Mogote	25-33N-6E	9300	" "	25.7	33.3	30.9	7.8	10.6	10.2
74	LaVeta Pass #2	SanCristo Cr.	"	LaVeta Pass	22-28S-70W	9300	SanCristoGr	26.8	30.4	33.4	8.0	9.8	11.4
76	Summitville	Wightman Cr.	"	Summitville	30-37N-4E	11500	Rio Grande	69.2	80.3	72.5	21.1	25.3	21.3
77	Cumbres Pass #2	Los Pinos R.	"	Cumbres Pass	17-32N-5E	10000	" "	74.7	74.2	87.1	28.1	25.6	29.4
80	Santa Maria	N.Clear Cr.	"	Santa Maria Res.	8-41N-2W	9700	" "	15.5	32.2	14.5	4.5	8.9	3.4
82	Culebra	Culebra R.	"	12mi.E.SanLuis	37.2N105.2W	10000	SanCristoGr	37.0	35.2	50.0	11.4	11.0	12.7
84	Fort Garland	Big Ute Cr.	"	6mi.N.Ft.Garland	13-29N-72W	8200	" " "	11.8	11.8	13.2	4.0	2.9	3.7
1	Red River	Red River	N.Mex.	6mi.SE.Red River	29-28N-15E	9500	Carson	28.0	32.5	41.4	9.8	10.3	16.0
2	Taos Canyon	Rio de Taos	"	14mi.E.Taos	10-25N-15E	9000	"	19.8	20.7	34.2	6.8	6.6	12.4
4	Aspen Grove	Rio En Medio	"	10mi.NE.SantaFe	12-18N-10E	9100	Santa Fe	13.5	17.9	26.4	4.1	5.6	7.3
5	Lee Ranch	Jemez Cr.	"	5mi.NW.Bland	3-18N-4E	9050	" "	26.7	30.4	34.7	8.6	9.4	9.7
6	Canjilon	Canjilon Cr.	"	8mi.NE.Canjilon	4-26N-6E	9500	Carson	56.0	51.7	66.6	24.1	20.8	26.5
9	Hematite Park*	Red River	"	3mi.SE.Red R.	8-28N-15E	9500	Carson	18.6	27.4	29.3	6.1	8.4	10.8
12	Tres Ritos	Agua Piedra	"	7mi.W.Holman	23-22N-13E	9000	"	18.1	22.8	29.2	5.7	6.6	9.5
15	Pay Role	Spring Creek	"	6mi.SE.Hopewell	23-28N-7E	9700	"	33.3	33.9	35.9	10.2	10.6	11.2
16	Jicarilla	Rock Lake Cr.	"	15mi.S.Dulce	9-29N-1W	8500	JicarillaR		2.3	9.6		0.5	2.3
17	Chama Divide	Willow Creek	"	6mi.W.Chama	36 .9N106.7W	7750	Off Forest	10.2	10.8	17.4	3.3	2.8	5.3
18	Chamita	Chamita Cr.	"	6mi.NW.Chama	36.9N106.7W	8500	" "	32.0	30.2	36.0	10.3	10.1	11.4
19	Cordova	Cordova Canyon	"	2mi.W.TresRitos	22-22N-13E	10100	Carson	44.4	41.1	50.4	14.2	12.9	16.6
20	Panchuela #2*	Rio Nambe	"	2mi.N.Cowles	27-19N-12E	8300	Santa Fe	7.3	10.1	9.8	2.4	3.3	3.0
21	Big Tesuque	Big Tesuque Cr.	"	10mi.NE.SantaFe	17-18N-11E	10000	" "	22.8	24.2	30.4	7.8	8.6	10.2
					Average	for drainage		31.4	35.6	38.9	10.5	11.7	12.6

*On adjacent drainage
@Average for period of record.

RIO GRANDE WATERSHED

Summary of Federal and State Cooperative Snow Surveys
Issued April 10, 1945, at Fort Collins, Colo.

No.	Main Drainage and Snow Course	Local Drainage	Location			Elev.	National Forest	Apr. 1 Snow Cover Measurements					
			State	Locality	Description			Av. Snow Depth			Av. Water Content		
								Av.@	1944	1945	Av.@	1944	1945
								In.	In.	In.	In.	In.	In.
	CHAMA RIVER												
77	Cumbres Pass #2	Los Pinos R.	Colo.	Cumbres Pass	17-32N-5E	10000	Rio Grande	74.7	74.2	87.1	28.1	25.6	29.4
6	Canjilon	Canjilon Cr.	N.Mex.	8mi.NE.Canjilon	4-26N-6E	9500	Carson	56.0	51.7	67.1	24.1	20.8	26.5
15	Pay Role	Spring Creek	"	6mi.SE.Hopewell	23-28N-7E	9700	"	33.3	33.9	35.9	10.2	10.6	11.2
16	Jicarilla	Rocky Lake Cr.	"	15mi.S.Dulce	9-29N-1W	8500	JicarillaR.		2.3	9.6		0.5	2.3
17	Chama Divide	Willow Creek	"	6mi.W.Chama	36.9N-106.7W	7750	OffForest	10.2	10.8	17.4	3.3	2.8	5.3
18	Chamita	Chamita Cr.	" "	6mi.NW.Chama	36.9N-106.7W	8500	" "	32.0	30.2	36.0	10.3	10.1	11.4
					Average for Drainage			41.2	40.2	48.7	15.2	14.0	16.8
	PECOS RIVER												
4	Aspen Grove*	Holy Ghost Cr.	N.Mex.	10mi.NE.Santa Fe	12-18N-10E	9100	Santa Fe	13.5	17.9	26.4	4.1	5.6	7.3
20	Panchuela #2	Panchuela Cr.	"	2mi.N.Cowles	27-19N-12E	8300	Santa Fe	7.3	10.1	9.8	2.4	3.3	3.0
21	Big Tesuque*	Holy Ghost Cr.	" "	10mi.NE.Santa Fe	17-18N-11E	10000	Santa Fe	22.8	24.2	30.4	7.8	8.6	10.2
					Average for Drainage			14.5	17.4	22.2	4.8	5.8	6.8
	CANADIAN RIVER												
9	Hematite Park	Moreno Creek	N.Mex.	3mi.SE.Red R.	8-28N-15E	9500	Carson	18.6	27.4	29.3	6.1	8.4	10.8
10	Ocate Mesa	Ocate Creek	"	3mi.E.Black L.	25-24N-16E	9200	Off Forest	12.0	21.7	12.8	3.7	5.8	3.2
12	Tres Ritos*	Luna Creek	"	7mi.W.Holman Hill	23-22N-13E	9000	Carson	18.1	22.8	29.2	5.7	6.6	9.5
19	Cordova*	Luna Creek	"	2mi.W.Tres Ritos	22-22N-13E	10100	"	44.4	41.1	50.4	14.2	12.9	16.6
					Average for Drainage			23.3	28.2	30.4	7.4	8.4	10.0

*On adjacent drainage
@Average for period of record

The following organizations cooperate in the snow surveys and irrigation water supply forecasts for the Colorado, Missouri-Arkansas and Rio Grande watersheds by furnishing funds or services.

STATE
- Colorado State Engineer
- Wyoming State Engineer
- Utah State Engineer
- New Mexico State Engineer
- Montana State Engineer
- Nebraska State Engineer
- Colorado Experiment Station
- Colorado Extension Service
- Montana Experiment Station
- Utah Experiment Station

FEDERAL
- Department of Agriculture
  - Forest Service
  - Soil Conservation Service
- Department of Interior
  - Bureau of Reclamation
  - Indian Service
  - Geological Survey
  - National Park Service
- Department of Commerce
  - Weather Bureau
- War Department
  - Army Engineer Corps

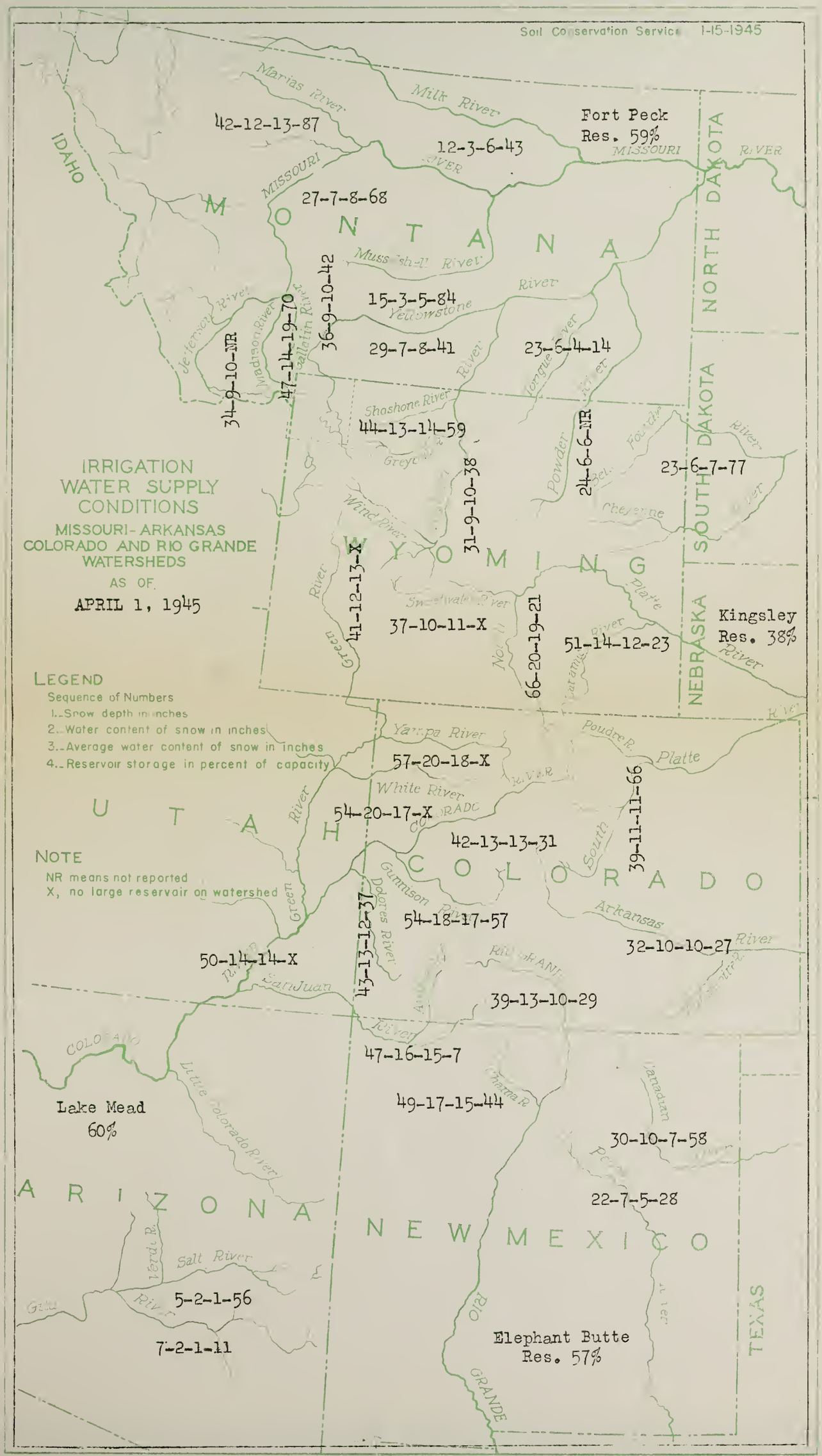
PUBLIC UTILITIES
- Colorado Public Service Company
- Western Colorado Power Company
- Montana Power Company
- Denver and Rio Grande Western R. R. Company

MUNICIPALITIES
- City of Bozeman
- City of Denver
- City of Boulder

WATER USERS ORGANIZATIONS
- Poudre Valley Water Users' Association
- Arkansas Valley Ditch Association
- Colorado River Water Conservation District

IRRIGATION PROJECTS
- Farmers Reservoir and Irrigation Company
- San Luis Valley Irrigation District
- Santa Maria Reservoir Company
- Costilla Land Company
- Uncompahgre Valley Water Users' Association
- Wyoming Development Company
- Goshen Irrigation District
- Kendrick Project
- Pathfinder Irrigation District
- Salt River Valley Water Users' Association
- San Carlos Irrigation and Drainage District

Many other organizations and individuals furnish valuable information for the snow survey reports. Their cooperation is gratefully acknowledged.


Soil Conservation Service 1-15-1945
IRRIGATION WATER SUPPLY CONDITIONS
MISSOURI-ARKANSAS COLORADO AND RIO GRANDE WATERSHEDS
AS OF
APRIL 1, 1945
LEGEND
Sequence of Numbers
1.-Snow depth in inches
2.-Water content of snow in inches
3.-Average water content of snow in inches
4.-Reservoir storage in percent of capacity
NOTE
NR means not reported
X, no large reservoir on watershed
42-12-13-87
12-3-6-43
Fort Peck Res. 59%
27-7-8-68
36-9-10-42
15-3-5-84
29-7-8-41
23-6-4-14
34-9-10-NR
47-14-19-70
44-13-14-59
24-6-6-NR
23-6-7-77
31-9-10-38
41-12-13-X
37-10-11-X
66-20-19-21
51-14-12-23
Kingsley Res. 38%
57-20-18-X
54-20-17-X
42-13-13-31
39-11-11-66
54-18-17-57
43-13-12-37
50-14-14-X
32-10-10-27
39-13-10-29
47-16-15-7
49-17-15-44
30-10-7-58
22-7-5-28
Lake Mead 60%
5-2-1-56
7-2-1-11
Elephant Butte Res. 57%
MONTANA
IDAHO
WYOMING
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
COLORADO
UTAH
ARIZONA
NEW MEXICO
TEXAS
Marias River
Milk River
MISSOURI RIVER
Musselshell River
Yellowstone River
Jefferson River
Madison River
Gallatin River
Shoshone River
Wind River
Powder River
Tongue River
Cheyenne River
Big Horn River
Platte River
Yampa River
White River
Green River
Gunnison River
South Platte River
Arkansas River
San Juan River
Colorado River
Little Colorado River
Salt River
Verde River
Gila River
Rio Grande
Canadian River
Chama R.